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(54) An air distribution valve for an air heater

(57) An air distribution valve 1, for an air heater of for example a motor vehicle, is rotatable between four positions to control distribution of air by means of vanes 3,4 from a cold air inlet 7 and a hot air inlet 6 to an outlet 8 which leads to fresh air vents, an outlet 9 which leads to windscreen vents and an outlet 10 which leads to footwell vents. In the preferred embodiment, selection of the different settings of the heater is achieved by simply rotating the valve member 1. Preferably the valve also includes a third vane 5 to assist in the air distribution.

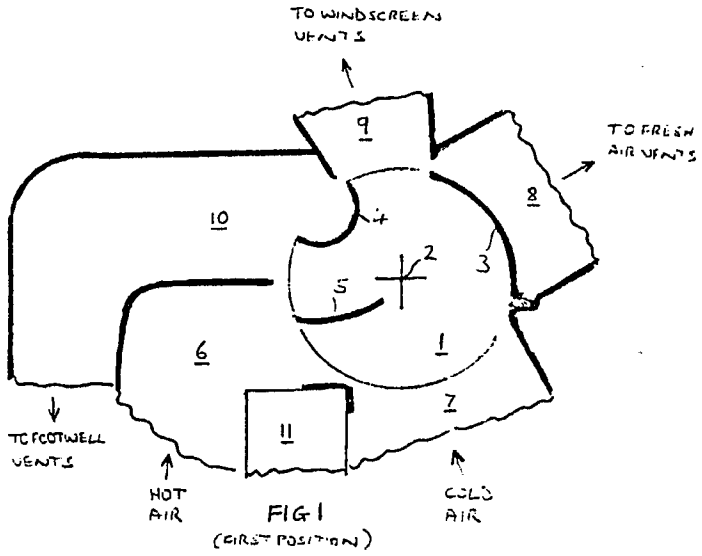

FIG 1
(FIRST POSITION)

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The drawing of Fig 5 originally filed was informal and the print thereof here reproduced is taken from a later filed formal copy.

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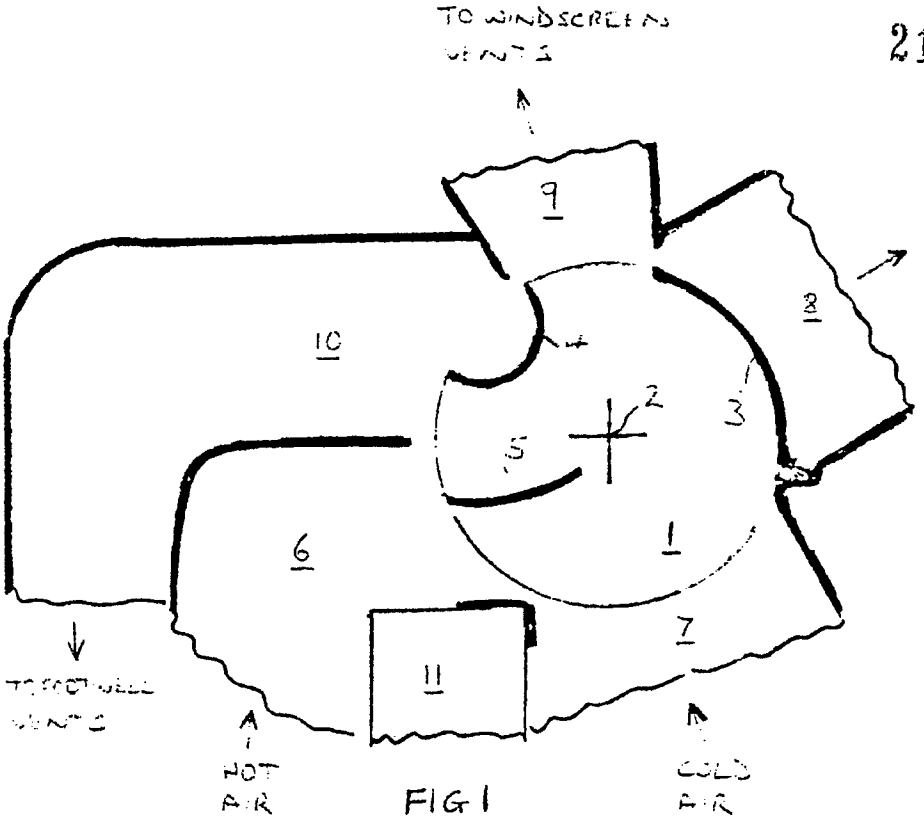

FIG 1
(FIRST POSITION)

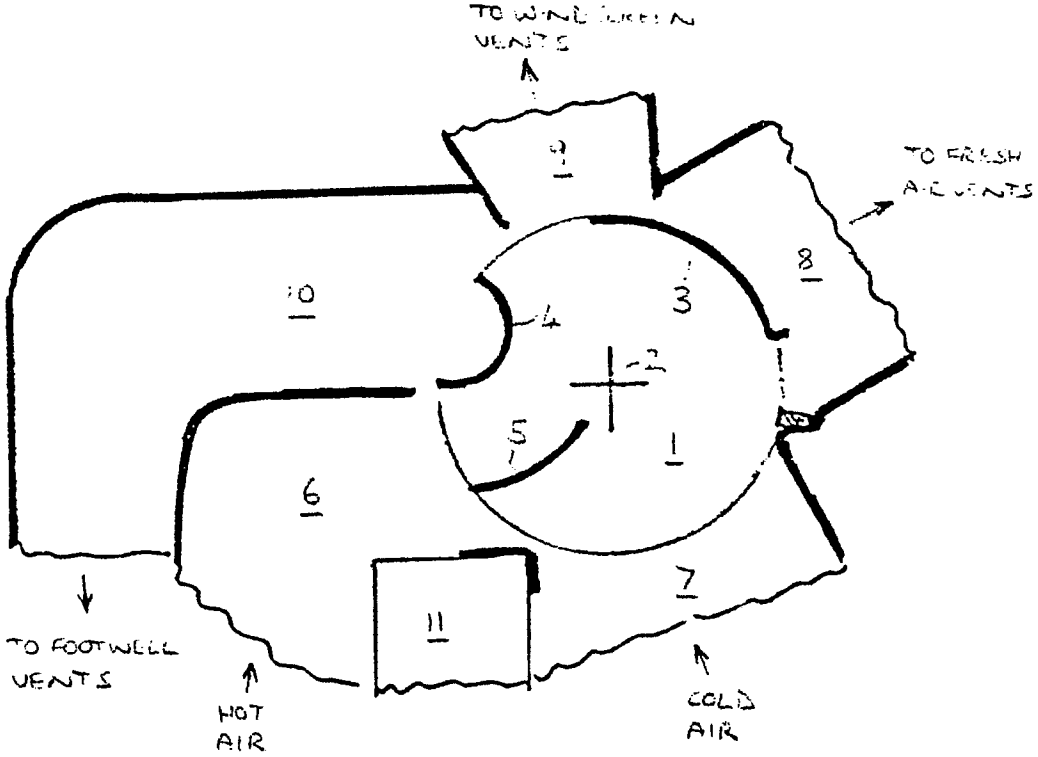

FIG 2
(SECOND POSITION)

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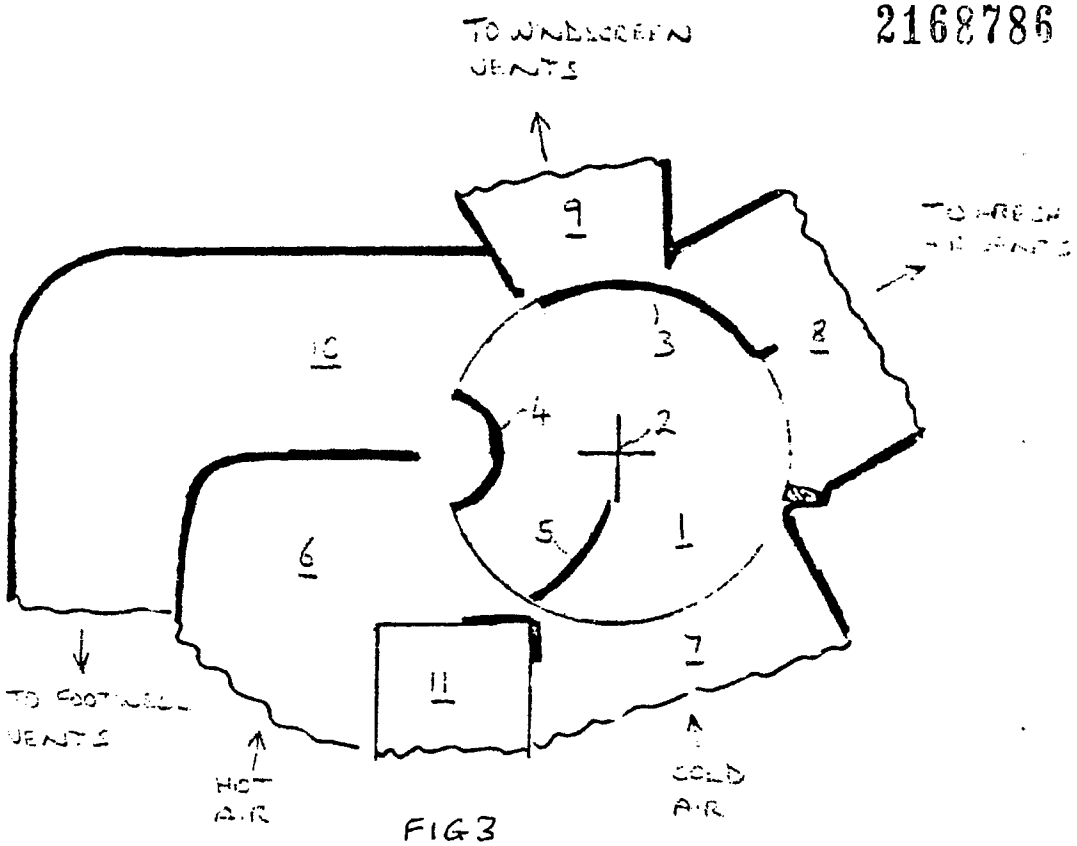

FIG 3
(THIRD POSITION)

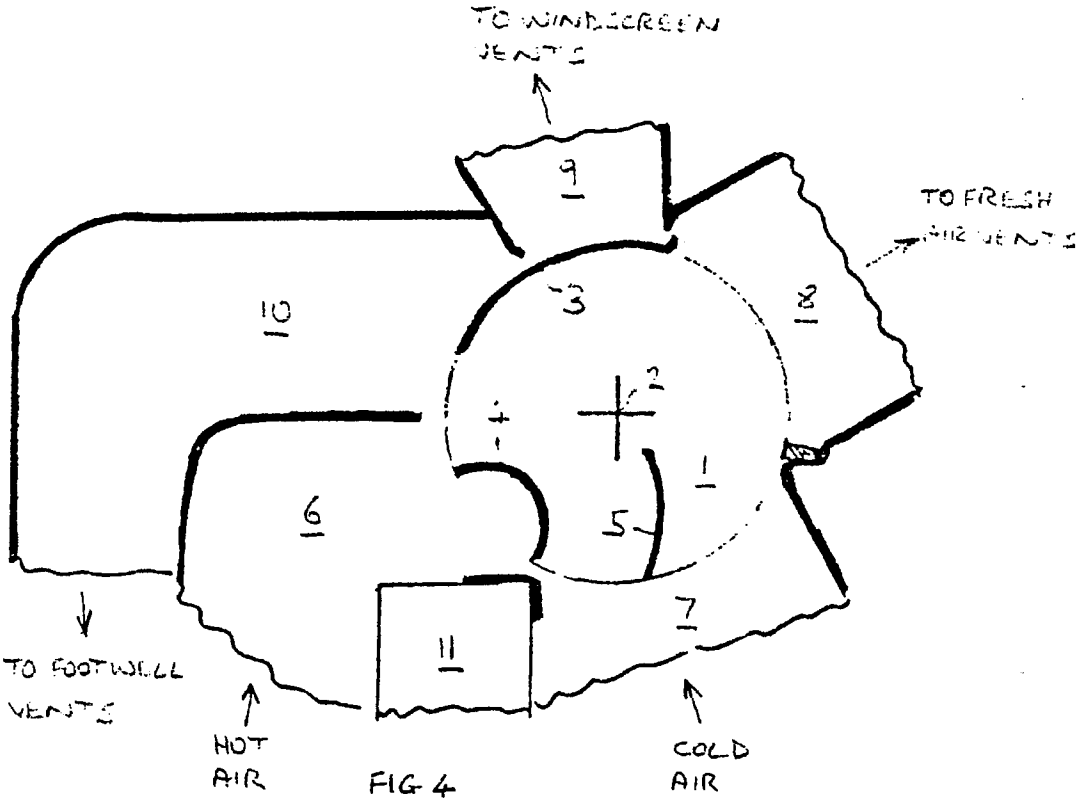

FIG 4
(FOURTH POSITION)

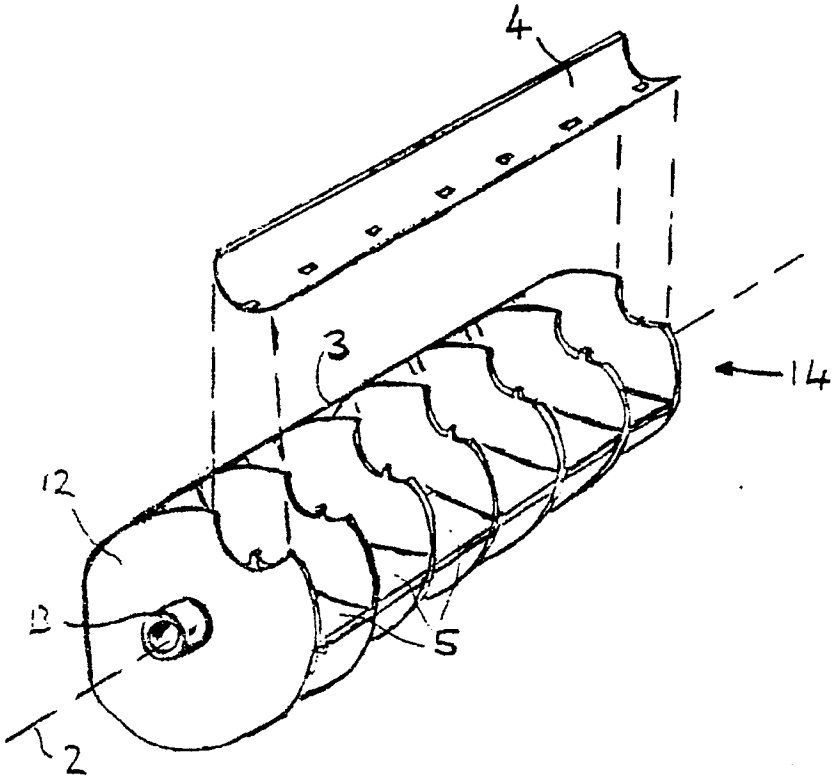

FIG 5

SPECIFICATION

An air distribution valve for an air heater

This invention relates to an air distribution valve for an air heater, for example an air heater for the interior of a motor vehicle.

An air heater for the interior of a motor vehicle is usually required to have a plurality of settings whereby hot, warm or cold air can be supplied to selected vents. Known arrangements employ a plurality of independent flaps for occluding inlet and/or outlets of the heater to shut-off or permit flow of air to selected vents. The control mechanism for such flaps tends to be complicated and comprise wires, levers and/or cams.

According to this invention there is provided an air distribution valve for an air heater comprising a hot air inlet, a cold air inlet, a cold air outlet, a hot air outlet, a warm air outlet, and a valve member movable between four positions, the valve member having two vane members arranged such that in use: with the valve member in the first position, the first vane member substantially occludes the cold air outlet and the second vane member at least partially occludes the hot air outlet so that the majority of the incoming air passes out through the warm air outlet; with the valve means in the second position, the first vane member partially occludes the cold air outlet and the warm air outlet and the second vane member partially occludes the hot air outlet so that the incoming air passes out through the cold air outlet, warm air outlet and the hot air outlet; with the valve member in the third position, the first vane member substantially occludes the warm air outlet so that the majority of the incoming air passes out through the cold air outlet and the hot air outlet; and, with the valve member in the fourth position, the first vane member substantially occludes the warm air outlet and at least partially occludes the hot air outlet and the second vane member at least partially occludes the hot air inlet so that the majority of the incoming cold air passes out through the cold air outlet and the hot air outlet.

This invention thus has a single valve member which can be set in four positions.

Preferred features of this invention will be apparent from the subsidiary claims of the specification.

This invention will now be described, merely by way of example, with reference to the accompanying drawings, in which:

Figures 1 to *4* are cross-sectional drawings illustrating four settings of an air distribution valve according to this invention incorporated in an air heater for the interior of a motor vehicle; and

Figure 5 is a perspective drawing of part of the air distribution valve illustrated in Figures 1 to 4.

Figures 1 to 4 show a cross-section of part of an air heater for the interior of a motor vehicle. The drawings show a valve member 1 which is rotatable about an axis 2 and which has three vane members 3, 4 and 5. The valve member 1 controls the flow of air from a hot air inlet 6 and a cold air inlet 7 to a cold air outlet 8, a warm air outlet 9 and a hot air outlet 10. The cold air inlet 7 may receive cold air from a fan (not shown) and the hot air inlet may receive air from the fan via a heat exchanger 11. The cold air outlet 8 may be arranged to lead to fresh air vents (not shown), the warm air outlet to windscreen vents (not shown) and the hot air outlet 10 to footwell vents (not shown). The valve member 1 may be rotated about axis 2 so that the first and second vane members 3 and 4 occlude selected outlets 8, 9 and 10 and so that the third vane member assists in directing air from the inlets 6 and 7 towards selected outlets 8, 9 and 10. The valve member 1 has four main settings which will be described with reference to Figures 1 to 4.

Figure 1 shows the valve member 1 in a first position designated "screen" in which warm air is to be passed through the warm air outlet 9 to de-mist a windscreen. With the valve member 1 in the first position, the first vane member 3 occludes the cold air outlet 8 and partially occludes the hot air outlet 10. The majority of the incoming air is therefore passed through the warm air outlet 9 to the windscreen vents. As the cold air outlet 8 is occluded no air passes out through the fresh air vents even if these have been left open. Little air passes through the hot air outside 10 and the third vane member 5 assists in directing incoming hot air supplied to inlet 6 towards the warm air outlet 9. The second vane member 4 is also shaped to assist in directing air towards the warm air outlet 9. Cold air from inlet 7 and hot air from inlet 6 mix as they pass through the valve member 1 so warm air passes through the outlet 9.

Figure 2 shows the valve member 1 in the second position designated "screen and feet (and fresh air if vents open)" in which cold air is passed through the cold air outlet 8 to the fresh air vents, warm air is passed through the warm air outlet to the windscreen vents, and hot air is passed through the hot air outlet to the footwell vents. With the valve member 1 in the second position, the first vane member 3 only partially occludes the cold air outlet 8 and the warm air outlet 9 and the second vane member 4 only partially occludes the hot air outlet 10. The incoming air is thus divided between the three outlets. The third vane member 5 assists in directing hot air from the inlet 6 towards the warm air outlet 9 and the hot air outlet 10 and in directing cold air from the inlet 7 towards the cold air outlet 8 and the warm air outlet 9. The second vane member 4 is also shaped to assist in directing air towards the warm air outlet 9 and the hot air outlet 10. It will appreciated that some cold air from the inlet 7 is able to pass to the outlet 8 without mixing with any hot air and that some hot air from inlet 6 is able to pass to outlet 10 without mixing with any cold air. Between these two streams, the hot and cold air mix so that warm air passes through the outlet 9. It has been found that except when the heater unit is set in the "hot" position, ie the temperature of the hot air supplied to inlet 6 is maximised, the temperature of the air passing through the cold air outlet 8 to the fresh air vents is substantially lower than that of the air passing through the hot air outlet 10 to the footwell vents.

Figure 3 shows the valve member 1 in the third

position designated "feet (and fresh air vents if open)" in which cold air is passed through the cold air outlet 8 to the fresh air vents and hot air is passed through the hot air outlet 10 to the footwell vents. With the valve member 1 in the third position, the first vane member 3 occludes the warm air outlet 9 and only partially occludes the cold air outlet 8. The majority of the incoming air therefore passes out through the cold air outlet 8 and the hot air outlet 10. The second vane member 4 assist in directing hot air from the inlet 6 towards the hot air outlet 10 and the third vane member 5 assists in directing hot air from the inlet 6 towards the hot air outlet 10 and cold air from the inlet 7 towards the cold air outlet 8. Some cold air from the inlet 7 is able to pass to the outlet 8 without mixing with any hot air and it has been found that except when the heater unit is set in the "hot" position the temperature of the air passing through the cold air outlet 8 is substantially lower than that of the hot air passed through the hot air outlet 10.

Figure 4 shows the valve member 1 in the fourth position designated "maximum fresh air" in which the cold air outlet 8 is fully open to pass air to the fresh air vents and the hot air inlet 6 is partially closed to restrict the passage of hot air to any of the outlets. With the valve member 1 in the fourth position, the first vane member 3 occludes the warm air outlet 9 and partially occludes the hot air outlet 10 and the second vane member 4 partially occludes the hot air inlet 6. The majority of the incoming cold air therefore passes through the cold air outlet 8 and the hot air outlet 6. The third vane member 5 assists in directing cold air from the inlet 7 towards the cold air outlet 8 and the hot air outlet 10. If the heater unit is set in the "cold" position, ie the temperature of the hot air supplied to the inlet 6 is minimised, the temperature of the air passing through the hot air outlet 10 is substantially the same as that passing through the cold air outlet 8.

It will be appreciated that the arrangement described above in which the valve member 1 is rotatable between the four positions is highly convenient as the setting of the valve member 1 may be controlled by means of a simple rotatable knob on a vehicle dashboard. However, other arrangements in which a valve member functions in the same manner can be envisaged.

With the arrangement illustrated in the drawings it is convenient to arrange for the angle of rotation of the valve member 1 between the first and third positions to be substantially the same as that between the third and fourth positions.

It will also be appreciated that the arrangement of the inlet and the outlets around the valve member 1 in the order illustrated in the drawings is highly convenient, particularly when the arrangement is used to heat the interior of a motor vehicle. However, other arrangements of the inlets and outlets can be envisaged.

Figure 5 shows a perspective view of the valve member 1 used in Figures 1 to 4. The vale member 1 comprises a plurality of discs 12 spaced at intervals along a shaft 13 which is to be mounted along axis 2. First and second vane members 3 and 4 are provided between each pair of adjacent discs 12. The disc 12, shaft 13, and first and second vane members 3 and 4 may be formed as a unitary body 14, for instance by a plastics moulding. In this case, the third vane members comprise a separate component 4 in the form of a strip with an arcuate cross-section as illustrated in Figure 5. This component is designed to clip onto lugs provided on the unitary body 14. The number of discs and hence units making up the valve member 1 is of course selected to suit the particular application.

As mentioned above, the air distribution valve described may be used in an air heater for the interior of a motor vehicle. Such a heater would also preferably be provided with a blend control for controlling the temperature of the hot air supplied to inlet 6 relative to the cold air supplied to the inlet 7. Such a blend control would be adjustable between the "hot" and "cold" positions mentioned above.

A further advantage of the arrangement described above is that pressure differentials across the vanes act through the axis 2 and do not therefore produce any torque tending to rotate the valve member 1. The valve member 1 is thus stable in each of the positions described and little torque is required to rotate it from one position to the next. In contrast, in prior art which employs flaps which are pivoted at the edge of an aperture, a pressure differential across the flap tends to rotate the flap to either open or close the aperture.

CLAIMS

1. An air distribution valve for an air heater comprising a hot air inlet, a cold air inlet, a cold air outlet, a hot air outlet, a warm air outlet, and a valve member movable between four positions, the valve member having two vane members arranged such that in use: with the valve member in the first position, the first vane member substantially occludes the cold air outlet and the second vane member at least partially occludes the hot air outlet so that the majority of the incoming air passes out through the warm air outlet; with the valve means in the second position, the first vane member partially occludes the cold air outlet and the warm air outlet and the second vane member partially occludes the hot air outlet so that the incoming air passes out through the cold air outlet, warm air outlet and the hot air outlet; with the valve member in the third position, the first vane member substantially occludes the warm air outlet so that the majority of the incoming air passes out through the cold air outlet and the hot air outlet; and, with the valve member in the fourth position, the first vane member substantially occludes the warm air outlet and at least partially occludes the hot air outlet and the second vane member at least partially occludes the hot air inlet so that the majority of the incoming cold air passes out through the cold air outlet and the hot air outlet.

2. A valve as claimed in claim 1 in which the valve member has a third vane member arranged such that in use: with the valve member in the second position, the third vane member assists in

directing incoming hot air towards the warm air outlet and the hot air outlet; and, with the valve member in the third position, the third vane member assists in directing incoming hot air towards the hot air outlet and incoming cold air towards the cold air outlet.

3. A valve as claimed in claim 1 or 2 in which the valve member is rotatable between the four positions.

4. A valve member as claimed in claim 3 in which the angle of rotation between the first and third positions is substantially the same as that between the third and fourth positions.

5. A valve as claimed in any preceding claim in which the inlet and outlets are arranged around the valve member in the following order: the hot air inlet, the cold air inlet, the cold air outlet, the warm air outlet and the hot air outlet.

6. A valve as claimed in claim 3 or any claim dependent thereon in which the valve member comprises a plurality of discs spaced at intervals along the axis of rotation thereof with a first vane member and a second vane member between each pair of adjacent discs.

7. A valve as claimed in claim 6 in which the discs and the first vane members comprise a unitary body and the second vanes comprise a separate component attached thereto.

8. A valve as claimed in any preceding claim in which the cold air inlet is arranged to receive air directly from a cold air source and the hot air inlet is arranged to receive air from the cold air source via a heat exchanger.

9. A valve as claimed in claim 8 in which the outlets communicate with the interior of a motor vehicle, the cold air outlet leading to a fresh air vent, the warm air outlet leading to a windscreen vent and the hot air outlet leading to a footwell vent.

10. An air distribution valve for an air heater substantially as hereinbefore described with reference to the accompanying drawings.

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